Ratios

For questions in the Quantitative Comparison format ("Quantity A" and "Quantity B" given), the answer choices are always as follows:

(A) Quantity A is greater.
(B) Quantity B is greater.
(C) The two quantities are equal.
(D) The relationship cannot be determined from the information given.

For questions followed by a numeric entry box, you are to enter your own answer in the box. For questions followed by fraction-style numeric entry boxes, you are to enter your answer in the form of a fraction. You are not required to reduce fractions. For example, if the answer is 1/4, you may enter 25/100 or any equivalent fraction.

All numbers used are real numbers. All figures are assumed to lie in a plane unless otherwise indicated. Geometric figures are not necessarily drawn to scale. You should assume, however, that lines that appear to be straight are actually straight, points on a line are in the order shown, and all geometric objects are in the relative positions shown. Coordinate systems, such as *xy*-planes and number lines, as well as graphical data presentations such as bar charts, circle graphs, and line graphs, *are* drawn to scale. A symbol that appears more than once in a question has the same meaning throughout the question.

1.

The ratio of men to women in a senior citizen garden club is 5 to 4.

Quantity A	Quantity B
The smallest possible number of members in the garden club	20

2.

In a certain children's class, there is a 2 to 3 ratio of boys to girls. The ratio of students from the north side of town to students from the south side of town is 4 to 3, and no student is from anywhere else.

Quantity A	Quantity B
The smallest possible number of students in the class	35

3.A pantry holds *x* cans of beans,tw ice as m any cans of soup,and half as m any cans of tom ato paste as there are cans of beans.If there are no other cans in the pantry,w hich of the follow ing could be the total num ber of cans in the pantry?

Indicate <u>tw o</u> such num bers.

☐ 6
☐ 7
☐ 36
☐ 45
☐ 63

4.If there are 20 birds and 6 dogs in a park,w hich of the follow ing represents the ratio of dogs to birds in the park?

(A) 3 : 13
(B) 3 : 10
(C) 10 : 3
(D) 13 : 3
(E) 1 : 26

5.O f the 24 children in a classroom ,12 are boys.W hich of the follow ing is the ratio of boys to girls in the classroom ?

(A) 1 : 1
(B) 1 : 2
(C) 2 : 1
(D) 1 : 3
(E) 3 : 1

6.If there are 24 w hite m arbles and 36 blue m arbles in a bag,w hat is the ratio of blue to w hite m arbles?

G ive your answ er as a fraction.

7.If there are 7 w hole bananas,14 w hole straw berries,and no other fruit in a basket,w hat is the ratio of straw berries to the total pieces of fruit in the basket?

G ive your answ er as a fraction.

8.The ratio of cheese to sauce for a single pizza is 1 cup to 1/2 cup.If B ob used 15 cups of sauce to m ake a num ber of pizzas,how m any cups of cheese did he use on those pizzas?

cups

9.Laura established a new flow er garden,planting 4 tulip plants to every 1 rose plant,and no other plants.If she planted a total of 50 plants in the garden,how m any of those plants w ere tulips?

tulip plants

10.The ratio of oranges to peaches to straw berries in a basket containing no other kinds of fruit is 2 : 3 : 4.If there are 8 oranges in the basket,a total of how m any pieces of fruit are in the basket?

(A) 16
(B) 32
(C) 36
(D) 48
(E) 72

11.A certain autom otive dealer sells only cars and trucks,and the ratio of cars to trucks on the lot is 1 to 3.If there are currently 51 trucks for sale,how m any cars does the dealer have for sale?

(A) 17
(B) 34
(C) 68
(D) 153
(E) 204

12.Last season,A rjun's tennis record w as 3 m atches w on for every 2 he lost.If he played 30 m atches last season,how m any did he w in?

(A) 10
(B) 12
(C) 18
(D) 20
(E) 50

13.A steel m anufacturer com bines 98 ounces of iron w ith 2 ounces of carbon to m ake one sheet of steel.H ow m any ounces of iron w ere used to m anufacture 1/2 of a sheet of steel?

(A) 1 (B
) 49 (C)
50 (D)
198
(E) 200

14.M aria uses a recipe for 36 cupcakes that requires 8 cups of flour,12 cups of m ilk,and 4 cups of sugar.H ow m any cups of m ilk w ould M aria require for a batch of 9 cupcakes?

(A) 2
(B) 3

(C) 4
(D) 6
(E) 8

15.In a certain orchestra,each m usician plays only one instrum ent and the ratio of m usicians w ho play either the violin or the viola to m usicians w ho play neither instrum ent is 5 to 9.If 7 m em bers of the orchestra play the viola and four tim es as m any play the violin,how m any play neither?

(A) 14
(B) 28
(C) 35
(D) 63
(E) 72

16.The ratio of 0.4 to 5 equals w hich of the follow ing ratios?

(A) 4 to 55
(B) 5 to 4
(C) 2 to 25
(D) 4 to 5
(E) 4 to 45

17.A t an anim al shelter,the ratio of cats to dogs is 4 to 7.If there are 27 m ore dogs than cats,how m any cats are at the shelter?

(A) 12
(B) 16
(C) 24
(D) 28
(E) 36

18.O n a w ildlife preserve,the ratio of giraffes to zebras is 37 : 43.If there are 300 m ore zebras than giraffes,how m any giraffes are on the w ildlife preserve?

(A) 1,550
(B) 1,850
(C) 2,150
(D) 2,450
(E) 2,750

19.O n a youth soccer team ,the ratio of boys to girls is 6 to 7.If there are 2 m ore girls than boys on the team ,how m any boys are on the team ?

(A) 12
(B) 18
(C) 24
(D) 30
(E) 36

20.A t a certain com pany,the ratio of m ale to fem ale em ployees is 3 to 4.If there are 5 m ore fem ale em ployees than m ale em ployees,how m any m ale em ployees does the com pany have?

(A) 12
(B) 15

(C) 18
(D) 21
(E) 24

21. On Monday, a class has 8 girls and 20 boys. On Tuesday, a certain number of girls joined the class just as twice that number of boys left the class, changing the ratio of girls to boys to 7 to 4. How many boys left the class on Tuesday?

(A) 5
(B) 6
(C) 11
(D) 12
(E) 18

22. If a dak is a unit of length and 14 daks = 1 jin, how many squares with a side length of 2 daks can fit in a square with a side length of 2 jin?

(A) 14
(B) 28
(C) 49
(D) 144
(E) 196

23.

In a group of adults, the ratio of women to men is 5 to 6, while the ratio of left-handed people to right-handed people is 7 to 9. Everyone is either left- or right-handed; no one is both.

Quantity A	**Quantity B**
The number of women in the group	The number of left-handed people in the group

24.

Party Cranberry is 3 parts cranberry juice and 1 part seltzer. Fancy Lemonade is 1 part lemon juice and 2 parts seltzer. One glass of Party Cranberry is mixed with an equally sized glass of Fancy Lemonade.

Quantity A	**Quantity B**
The fraction of the resulting mix that is cranberry juice	The fraction of the resulting mix that is seltzer

25.

The ratio of 16 to g is equal to the ratio of g to 49.

Quantity A	**Quantity B**
g	28

26. In a parking lot, 1/3 of the vehicles are black and 1/5 of the remainder are white. How many vehicles could be parked on the lot?

(A) 8
(B) 12
(C) 20
(D) 30
(E) 35

27.Three friends divided a bag of chocolates so that D avid received a fifth the num ber of chocolates that Fouad did, and Stina received 80 percent of the total num ber of chocolates.W hat is the ratio of the num ber of chocolates Stina received to the num ber that D avid received?

(A) 4 : 3
(B) 8 : 5
(C) 8 : 1
(D) 24 : 1
(E) 80 : 1

28.A new sport is played w ith team s m ade up of 2 forw ards,3 guards,and 1 goalie.There are 23 players available to play forw ard,21 other players available to play guard,and 9 other players available to play goalie.If the m axim um possible num ber of com plete team s are form ed,how m any of the available players w ill not be on a team ?

(A) 7
(B) 9
(C) 11
(D) 13
(E) 15

29.O il,vinegar,and w ater are m ixed in a 3 to 2 to 1 ratio to m ake salad dressing.If Larry has 8 cups of oil,7 cups of vinegar,and access to any am ount of w ater,w hat is the m axim um num ber of cups of salad dressing he can m ake w ith the ingredients he has available,if fractional cup m easurem ents are possible?

(A) 12
(B) 13
(C) 14
(D) 15
(E) 16

30.W ith *y* dollars,5 oranges can be bought.If all oranges cost the sam e,how m any dollars do 25 oranges cost,in term s of *y*?

(A) *y*/5
(B) *y*
(C) *y* +
5 (D) 5*y*
(E) 25*y*

31.A certain draw er contains only black and w hite socks.If the ratio of black socks to w hite socks is 3 : 4 and there are 15 black socks in the draw er,how m any socks total are in the draw er?

(A) 15
(B) 20
(C) 30
(D) 35
(E) 45

32.

A tree grow s taller at a constant rate.The ratio of its grow th in feet to the tim e spent grow ing in years is 4 : *x*.

Q uantity A	**Q uantity B**
The num ber of feet the tree grow s taller in 10 years	40

33.Ten robots painted 3 identical houses in 5 hours,w orking at a constant rate.H ow m any hours w ould it take 20 identical robots to paint 12 such houses,w orking at the sam e constant rate?

(A) 2.5
(B) 5
(C) 10
(D) 15
(E) 20

34.D ick takes tw ice as long as Jane to run any given distance.Starting at the sam e m om ent,D ick and Jane run tow ards each other from opposite ends of the schoolyard,a total distance of *x*,at their respective constant rates until they m eet.

Q uantity A	**Q uantity B**
The fraction of the total distance *x* that is covered by Jane	$\frac{2}{3}x$

35.O ne robot can pack a box in 15 m inutes.W orking together at the sam e constant rate,how m any boxes can 16 robots pack in 1 hour?

(A) 4
(B) 16
(C) 24
(D) 64
(E) 256

36.A w om an spent $\frac{5}{8}$ of her w eekly salary on rent,and $\frac{1}{3}$ of the rem ainder on food,leaving $40 available for other expenses.W hat is the w om an's w eekly salary?

(A) $160
(B) $192
(C) $216
(D) $240
(E) $256

37.A m ixture contains nothing but w ater and acetone in a ratio of 1 : 2.A fter 200 m L of w ater is added to the m ixture the ratio of w ater to acetone is 2 : 3.

Q uantity A	**Q uantity B**
The original volum e of the m ixture	1,800 m L

38.In a certain rectangle,the ratio of length to w idth of a rectangle is 3 : 2 and the area is 150 square centim eters. W hat is the perim eter of the rectangle,in centim eters?

(A) 10
(B) 15
(C) 25
(D) 40
(E) 50

39.A t a certain college,the ratio of students to professors is 8 : 1 and the ratio of students to adm inistrators is 5 : 2. N o person is in m ore than one category (for instance,there are no adm inistrators w ho are also students).

Q uantity A	**Q uantity B**
The fractional ratio of professors to adm inistrators	$\frac{5}{8}$

40.M ary prepared *x* pounds of pasta for the *y* people expected to attend a banquet.If only *z* of these *y* people actually attend,such that $z < y$,how m any pounds of pasta w ill be left over if M ary serves the originally intended portion to each of the guests in attendance?

(A) $\frac{x(y-z)}{y}$
(B) $\frac{zx}{y}$
(C) $\frac{x-z}{y}$
(D) $\frac{x(z-y)}{y}$
(E) $\frac{x(y+z)}{y}$

41.Sara purchased a num ber of w renches and ham m ers from a hardw are store,such that the ratio of w renches to ham m ers purchased w as 5 : 4 and she purchased 10 m ore w renches than ham m ers.

Q uantity A	**Q uantity B**
The num ber of ham m ers Sara purchased from the hardw are store	50

42.A fam ily drove from hom e to a vacation destination 100 m iles aw ay,driving the first half of the distance at a constant speed of 50 m iles per hour and the second half of the distance at a constant speed of 20 m iles per hour. R eturning hom e by the sam e route,they traveled at a constant speed of 30 m iles per hour for the w hole trip.

Q uantity A	**Q uantity B**
The num ber of hours it took to drive from hom e to the vacation destination	The num ber of hours it took to drive from the vacation destination back hom e

43.A hose is filling a large bucket w ith w ater at a constant rate of 3 gallons per m inute.The bucket is losing w ater through a leak at a constant rate of 1 gallon per m inute.If the bucket can hold a total volum e of 8 gallons,how m any m inutes are required to fill the bucket to capacity,starting from em pty?

(A) 2
(B) 3
(C) 4
(D) 5
(E) 6

44.If D an can m ake 10 w idgets every 15 seconds,how m any w idgets can D an m ake in 1 hour,w orking at this constant rate?

(A) 40
(B) 240
(C) 600
(D) 2,400
(E) 4,000

45.In a certain country,8 rubels are w orth 1 schilling,and 5 schillings are w orth 1 lem uw .In this country,6 lem uw s are equivalent in value to how m any rubels?

(A) 20/3
(B) 30
(C) 40
(D) 48
(E) 240

46.The ratio of K im 's tim e to paint a house to Jane's tim e to paint a house is 3 : 5.If K im and Jane w ork together at their respective constant rates,they can paint a house in 10 hours.

Q uantity A	**Q uantity B**
The num ber of hours it takes K im to paint the house alone	16

47.Team A and Team B are raising m oney for a charity event.The ratio of m oney collected by Team A to m oney collected by team B is 5 : 6.The ratio of the num ber of students on Team A to the num ber of students on Team B is 2 : 3.W hat is the ratio of m oney collected per student on team A to m oney collected per student on team B ?

(A) 4 : 5
(B) 5 : 4
(C) 5 : 6
(D) 5 : 9
(E) 9 : 5

48.K etchup,soy sauce,and m ayonnaise are m ixed together in a ratio of 3 : 2 : 5 to m ake M r.A nderson's special sauce.If M r.A nderson prepared 25 ounces of special sauce for his upcom ing barbeque,how m any ounces of soy sauce did he use?

(A) 2.5
(B) 5
(C) 7.5
(D) 10

(E) 12.5

49.Saul ran from point A to point B and then back again by the sam e route in 63 m inutes.It took Saul $\frac{3}{4}$ as m uch tim e to run from point A to point B as it took him to run from point B to point A .

Q uantity A	Q uantity B
The num ber of m inutes Saul's point A to point B run took	30

50.Jarod needs 2/3 of an ounce of vinegar for every 2 cups of sushi rice that he prepares.To prepare 7 cups of sushi rice in the sam e proportion,how m any ounces of vinegar does Jarod need?

(A) 3/2
(B) 4/3
(C) 7/3
(D) 7/2
(E) 14/3

51 Joe drove from Springfield to Shelbyville at *x* m iles per hour.H e then drove from Shelbyville to B akersfield at (1.5)*x* m iles per hour.If the distance betw een Springfield and Shelbyville is tw ice the distance betw een Shelbyville and B akersfield,w hat w as Joe's average speed for the entire trip?

(A) $\frac{9}{8}x$
(B) $\frac{6}{5}x$
(C) $\frac{5}{4}x$
(D) $\frac{7}{4}x$
(E) $\frac{9}{4}x$

52.The total cost of 3 bananas,2 apples,and 1 m ango is $3.50.The total cost of 3 bananas,2 apples,and 1 papaya is $4.20.The ratio of the cost of a m ango to the cost of a papaya is 3 : 5.

Q uantity A	Q uantity B
The cost of a papaya	$2.00

53.In a certain tow n, $\frac{2}{5}$ of the total population is em ployed.A m ong the unem ployed population,the ratio of m ales to fem ales is 5 : 7.If there are 40,000 em ployed people in the tow n,how m any fem ales are unem ployed?

(A) 16,000
(B) 25,000
(C) 35,000

(D) 65,000
(E) 75,000

54.

Q uantity A	Q uantity B
The ratio of $2\frac{11}{12}$ to $1\frac{3}{4}$	$\frac{5}{3}$

55.O n a certain m ap of the U nited States,3/5 of an inch represents a distance of 400 m iles.If O klahom a C ity and D etroit are separated on the m ap by approxim ately 3/2 of an inch,w hat is the approxim ate distance betw een them in m iles?

(A) 240
(B) 360
(C) 600
(D) 800
(E) 1,000

56.A m achine can m anufacture 20 cans per hour,and exactly 10 such cans fit into every box.M aria packs cans in boxes at a constant rate of 3 boxes per hour.If the m achine ran for 2 hours and w as then turned off before M aria started packing the cans in boxes,how m any m inutes w ould it take M aria to pack all the cans that the m achine had m ade?

(A) 40
(B) 45
(C) 80
(D) 160
(E) 800

57.A t C om pany X ,a person’s pay is increased by the sam e dollar am ount every year that he or she w orks for C om pany X .Since Joe started w ith C om pany X ,he has seen 10 such raises,and the ratio of his pay now to his pay w hen he started is 5 : 2.W hat is the ratio of Joe’s yearly pay increase to his starting pay?

(A) 1/4
(B) 3/20
(C) 5/3
(D) 4/1
(E) 20/3

58.If B eth has 1/4 m ore m oney than A ri,and each person has an integer num ber of dollars,w hich of the follow ing could be the com bined value of B eth and A ri’s m oney?

Indicate <u>all</u> such values.

☐ $12
☐ $54
☐ $72
☐ $200

59.If salesperson A sold 35% m ore m otorcycles than salesperson B ,w hich of the follow ing could be the total num ber of m otorcycles sold by both salespeople?

Indicate <u>all</u> such total num bers of m otorcycles.

☐ 47
☐ 70
☐ 135
☐ 235

60.A zoo has tw ice as m any zebras as lions and four tim es as m any m onkeys as zebras.W hich of the follow ing could be the total num ber of zebras,lions,and m onkeys at the zoo?

Indicate <u>all</u> such totals.

☐ 14
☐ 22
☐ 28
☐ 55
☐ 121

61.In N ation Z,10 terble coins equal 1 galok.In N ation Y ,6 barbar coins equal 1 m urb.If a galok is w orth 40% m ore than a m urb,w hat is the ratio of the value of 1 terble coin to the value of 1 barbar coin?

(A) $\frac{3}{5}$
(B) $\frac{11}{13}$
(C) $\frac{3}{7}$
(D) $\frac{21}{23}$
(E) $\frac{21}{25}$

62.A utolot has a 2 : 1 ratio of blue cars to red cars and a 6 : 1 ratio of red cars to orange cars on the lot.W hat could be the total num ber of blue,red and orange cars on the lot?

(A) 38
(B) 39
(C) 40
(D) 41
(E) 42

63.O riginally,70% of the clients at B ob's D ating B istro w ere m ale.A fter *z* of the fem ale clients left,the service still had 74 clients.W hich of the follow ing could be the value of *z*?

Indicate <u>all</u> such values.

- ☐ 4
- ☐ 6
- ☐ 12
- ☐ 16
- ☐ 18

64. Beaker B has a volume of b, which is twice the volume c of Beaker C. The volume of Beaker C is one third the volume g of Beaker G.

Quantity A	**Quantity B**
$\frac{b+c}{g}$	1

R atios A nsw ers

1.**(B).**The ratio of m en to w om en is 5 to 4.Since both 5 and 4 are w hole num bers,they could actually *be* the num ber of m en and w om en,respectively.

5 and 4 are also the *low est* possible num bers of m en and w om en,because reducing the ratio of 5 to 4 any further is im possible w ithout m aking one part a non-integer (e.g.,2.5 to 2) or both parts negative,and the num bers of m en and w om en m ust be positive.

So the sm allest num ber of people w ho could be in the garden club is 5 + 4 = 9,w hich is less than 20.Q uantity B is greater.

2.**(C).**W hen a ratio includes things you can count (such as people),each group m ust be a positive m ultiple of the num bers in the ratio.For instance,the ratio of boys to girls is 2 to 3.So the num ber of boys is $2n$ and the num ber of girls is $3n$,w here n is a positive integer.The total num ber of students is $2n + 3n = 5n$,w hich is a positive m ultiple of 5.

U sing the second ratio,w rite the num ber of students from the north side as $4m$ and the num ber of students from the south side as $3m$,w here m is a positive integer.The total num ber of students is $4m + 3m = 7m$,w hich is a positive m ultiple of 7.

The sm allest num ber that is a positive m ultiple of both 5 and 7 is 35.The tw o quantities are equal.

3.**II and V only.**W rite the num ber of each type of can.

C ans of beans = x C ans of soup = $2x$ C ans of tom ato paste = $0.5x$

Since each num ber of cans m ust be an integer,you know that $0.5x = n$,w here n is som e positive integer.This m eans $x = 2n$.(In other w ords,x is even.)

The total num ber of cans is $x + 2x + 0.5x = 3.5x$.N ow substitute in $2n$:

Total = $3.5x = 3.5(2n) = 7n$.So the total num ber of cans is a m ultiple of 7.

O f the answ er choices,only 7 and 63 are m ultiples of 7.

4.**(B)** If there are 6 dogs and 20 birds in the park,the ratio of dogs to birds is 6 : 20,w hich reduces to 3 : 10.

5.**(A).**If 12 of 24 children in the classroom are boys,then the rem aining 24 - 12 = 12 children are girls.Therefore the ratio of boys to girls in the classroom is 12 : 12.R educe this ratio by dividing both sides by the com m on factor of 12.The reduced ratio is $\frac{12}{12} : \frac{12}{12}$ or 1 : 1.

B e sure to answ er the right question on a quick problem such as this one.The correct ratio of boys to all children is 1 : 2,w hich is also the correct ratio of girls to all children;how ever,the question asks for the ratio of boys to girls, w hich is 1 : 1.

6.$\frac{3}{2}$ **or any equivalent fraction.**If there are 36 blue m arbles and 24 w hite m arbles,the ratio of blue to w hite m arbles is 36 : 24.W rite this ratio as a fraction and cancel the com m on factor of 12 from top and bottom .

$\frac{36}{24} = \frac{3\times12}{2\times12} = \frac{3}{2}$.The the original ratio of $\frac{36}{24}$ w ould also be counted as correct if entered as-is.

7.$\frac{2}{3}$ **or any equivalent fraction.**If there are 7 bananas and 14 straw berries,then there are 7 + 14 = 21 total pieces of fruit.The ratio of straw berries to the total is therefore 14 : 21.W rite this ratio as a fraction and cancel the com m on factor of 7 from top and bottom .$\frac{14}{21} = \frac{2\times7}{3\times7} = \frac{2}{3}$.The original ratio of $\frac{14}{21}$ w ould also be counted as correct if entered as-is.

8.**30 cups.**To solve for the actual am ount of cheese B ob used,w ork w ith the Part : Part ratio.The ratio of cheese to sauce is $1 : \frac{1}{2}$,or $1x : \frac{1}{2}x$ (putting in an unknow n m ultiplier).W hen the actual am ount of sauce is $\frac{1}{2}x$,the actual am ount of cheese is 1*x*,or sim ply *x*.B ob used 15 cups of sauce.Solve for *x*:

$$\frac{1}{2}x = 15$$
$$x = 15(2)$$
$$x = 30$$

Since *x* also indicates the actual am ount of cheese,B ob used 30 cups of cheese.D on't go so fast on this sort of problem that you m ake a silly m istake,such as reversing the ratio and getting $\frac{1}{2}$ of 15,or 7.5 cups,as the incorrect answ er.

9.**40 tulip plants.**To solve for the num ber of tulips,w ork w ith the Part : Part : W hole ratio.The ratio of tulips to roses is 4 : 1,so the Tulip : R ose : Total relationship is 4 : 1 : 5.This ratio can be w ritten as 4*x* : 1*x* : 5*x*,w ith *x* as the unknow n integer m ultiplier.There are 50 total plants in the garden,so set 5*x* equal to 50 and solve for *x*:

$$5x = 50$$
$$x = 10$$

N ow plug this value into the expression for the actual num ber of tulips: 4*x* = 4(10) = 40.Laura planted 40 tulip plants in the garden.

10.**(C).**W ork w ith the Part : W hole ratio to solve for the total num ber of pieces of fruit.The ratio of oranges to peaches to straw berries is 2 : 3 : 4,so the Part : W hole relationship w ould include the total of 2 + 3 + 4 = 9,or 2 : 3 : 4 : 9 (three parts and a w hole).This four-w ay ratio can be w ritten as $2x : 3x : 4x : 9x$,w ith x as the unknow n m ultiplier. There are 8 oranges in the basket,so set the oranges part ($2x$) equal to 8 and solve for x.

$$2x = 8$$
$$x = 4$$

N ow plug this value into the expression for the w hole: $9x = 9(4) = 36$.There are 36 pieces of fruit total.

11.**(A).**Focus on the given Part : Part ratio.The ratio of cars to trucks is 1 : 3,or $x : 3x$ w ith x as the unknow n m ultiplier.Since there are 51 trucks for sale,set $3x$ equal to 51 and solve for x.

$$3x = 51$$
$$x = 17$$

Since x also represents the num ber of cars,the dealer has 17 cars for sale.

12.**(C).**W ork w ith the Part : Part : W hole ratio to solve for the num ber of w ins.The ratio of m atches w on to m atches lost is 3 to 2,so the W ins : Losses : Total ratio is 3 : 2 : 5.This ratio can be w ritten as $3x : 2x : 5x$,w ith x as the unknow n m ultiplier.A rjun played 30 m atches in all,so set $5x$ equal to 30 and solve.

$$5x = 30$$
$$x = 6$$

N ow plug this value into the expression for the num ber of w ins: $3x = 3(6) = 18$.A rjun w on 18 m atches.

13.**(B).**Iron and carbon com bine to m ake steel in a specific given ratio.The ratio of iron (ounces) to carbon (ounces) to steel (sheets) is 98 : 2 : 1.B ecause there are different units (ounces and sheets),the Part num bers do not add to the W hole num ber as they typically do,but don’t be concerned.

This ratio can be w ritten as $98x : 2x : x$,w ith x as the unknow n m ultiplier,w hich is also the num ber of sheets.To m ake 1/2 a sheet of steel,set x equal to 1/2.

N ow plug this value into the expression for the num ber of iron ounces: $98x = (98)(1/2) = 49$.To m ake 1/2 a sheet of steel,49 ounces of iron are required.

14.**(B).**A s a ratio,Flour : M ilk : Sugar : C upcakes is equal to 8 : 12 : 4 : 36,w here the first 3 num bers are in cups. B ecause there are different units (cups and cupcakes),the Part num bers do not add to the W hole num ber,but don’t be concerned.

This ratio can be w ritten as $8x : 12x : 4x : 36x$,w ith x as the unknow n m ultiplier.To m ake 9 cupcakes,set $36x$ equal to 9 and solve for x.

$$36x = 9$$
$$x = 1/4$$

In w ords,for a batch of 9 cupcakes,M aria w ould m ake 1/4 of the original recipe.

N ow plug this value into the expression for cups of m ilk: 12x = (12)(1/4) = 3.M aria w ould need 3 cups of m ilk.

15.**(D).**Since 7 m em bers of the orchestra play the viola and four tim es as m any play the violin,(7)(4) = 28 people m ust play the violin.A ll together,7 + 28 = 35 m usicians in the orchestra play either the viola or the violin.

The ratio of *either* to *neither* is 5 : 9,or 5x : 9x using the unknow n m ultiplier.Since 35 people play either instrum ent, set 5x equal to 35 and solve for x.

$5x = 35$
$x = 7$

N ow plug this value into the expression for *neither*: 9x = 9(7) = 63.There are 63 people in the orchestra w ho play neither instrum ent.

16.**(C).**Y ou can rew rite ratios as fractions and then m ultiply or divide top and bottom by the sam e num ber,keeping the ratio (or fraction) the sam e.

First,m ultiply top and bottom by 10,to rem ove the decim al. $\frac{0.4}{5}=\frac{0.4\times10}{5\times10}=\frac{4}{50}$

N ext,cancel the com m on factor of 2. $\frac{4}{50}=\frac{2\times2}{25\times2}=\frac{2}{25}$

Finally,the fraction $\frac{2}{25}$ is the sam e as the ratio of 2 to 25,w hich is therefore equivalent to the original ratio of 0.4 to 5.

17.**(E).**The ratio of cats to dogs is 4 : 7.B ecause the num ber of cats or dogs in this question can only be positive integers,introduce the unknow n m ultiplier x: the num ber of cats is 4x,and the num ber of dogs is 7x,w here x is a positive integer.

N ow translate the second sentence of the problem into algebra.“There are 27 m ore dogs than cats” becom es D ogs - C ats = 27,or 7x - 4x = 27.Solve for x:

$7x - 4x = 27$
$3x = 27$
$x = 9$

Finally,substitute into the expression for the num ber of cats: 4x = 4(9) = 36.There are 36 cats.

18.**(B).**The ratio of giraffes to zebras is 37 : 43.Introduce the unknow n m ultiplier x: the num ber of giraffes is 37x, and the num ber of zebras is 43x,w here x is a positive integer.

N ow translate the second sentence of the problem into algebra.“There are 300 m ore zebras than giraffes” becom es Zebras - G iraffes = 300,or 43x - 37x = 300.Solve for x:

$43x - 37x = 300$
$6x = 300$
$x = 50$

Finally,substitute into the expression for the num ber of giraffes: 37x = 37(50) = 1,850.There are 1,850 giraffes.

In a pinch,here’s a shortcut: the right answ er m ust be a m ultiple of 37,because the giraffe num ber in the ratio is 37, and you need a positive w hole num ber of giraffes.If you test the answ er choices,only 1,850 is divisible by 37.This shortcut doesn’t alw ays w ork this w ell,of course!

19.**(A).**The ratio of boys to girls is 6 : 7.If you introduce the unknow n m ultiplier x,the num ber of boys is 6x,and the num ber of girls is 7x,w here x is a positive integer.

N ow translate the second sentence of the problem into algebra.“There are 2 m ore girls than boys” becom es G irls - B oys = 2,or 7x - 6x = 2.Solve for x:

$7x - 6x =$
$2\ x = 2$

Finally,substitute into the expression for the num ber of boys: 6x = 6(2) = 12.There are 12 boys on the youth soccer team .

20.**(B).**The ratio of m ale to fem ale em ployees is 3 : 4.If you introduce the unknow n m ultiplier x,the num ber of m ales is 3x,and the num ber of fem ales is 4x,w here x is a positive integer.

N ow translate the second sentence of the problem into algebra.“There are 5 m ore fem ale em ployees than m ale em ployees” becom es Fem ales – M ales = 5,or 4x – 3x = 5.Solve for x:

$4x – 3x =$
$5\ x = 5$

Finally,substitute into the expression for the num ber of m ale em ployees: 3x = 3(5) = 15.There are 15 m ale em ployees.

21.**(D).**C all the num ber of girls w ho joined the class x,so the new num ber of girls in the class w as 8 + x.Tw ice as m any boys left the class,so the num ber of boys w ho left the class is 2x,and the new num ber of boys in the class w as 20 – 2x.

The resulting ratio of boys to girls w as 7 to 4.Since there is already a variable in the problem ,don’t use an unknow n m ultiplier.R ather,set up a proportion and solve for x.

$$\frac{\text{Girls}}{\text{Boys}} = \frac{8+x}{20-2x} = \frac{7}{4}$$

$4(8+x) = 7(20-$
$2x)$ $32+4x = 140-$
$14x$ $18x = 108$
$x = 6$

Finally,the question asks for the num ber of boys w ho left the class.This is $2x = 2(6) = 12$ boys.

C heck: There w ere 8 girls in the class,then 6 joined for a total of 14 girls.There w ere 20 boys in the class until 12 left the class,leaving 8 boys in the class.The resulting ratio of girls to boys w as $\frac{14}{8} = \frac{7\times 2}{4\times 2} = \frac{7}{4}$,as given.

22.**(E).**Since 14 daks = 1 jin,a length m easured in daks is 14 tim es the sam e length m easured in jins.In other w ords, the ratio of the length in daks to the length in jins is 14 to 1.

W rite this relationship as a fraction: $\frac{14 \text{ daks}}{1 \text{ jin}}$ .Y ou can also w rite $\frac{1 \text{ jin}}{14 \text{ daks}}$.Y ou can convert a m easurem ent from one unit to the other by m ultiplying by one of these unit conversion factors.

Side of big square: $(2 \text{ jins})\left(\frac{14 \text{ daks}}{1 \text{ jin}}\right) = 28$ .Since the sm all square has a side length of 2 daks,the num ber of sm all sides that w ill fit along a big side is 28 ÷ 2,or 14.

H ow ever,14 is not the right answ er.14 is the num ber of sm all squares that w ill fit along *one w all* of the big square,in one row .There w ill be 14 row s,so in all there w ill be (14)(14) = 196 sm all squares that fit inside the big square.

23.**(A).**W rite tw o different Part : Part : W hole relationships.In each relationship,the tw o parts sum to the w hole.

W om en : M en : Total = 5 : 6 : 11,so W om en : Total = 5 : 11.

Left-handed : R ight-handed : Total = 7 : 9 : 16,so Left-handed : Total = 7 : 16.

In other w ords,w om en account for $\frac{5}{11} = 45.\overline{45}\%$ of the group,left-handed people for $\frac{7}{16} = 43.75\%$ of the group.

Since the total num ber of people is the sam e (it's the sam e group,w hether divided by gender or handedness),the percents can be com pared directly.There m ust be m ore w om en than left-handed people in the group.Q uantity A is greater.

24.**(B).**B e careful — don't just add the "parts" from the different glasses,because the parts w ill generally not be the sam e size! Start by w riting Part : Part : W hole relationships for each glass.In each relationship,the w hole is the sum of the parts.

For Party C ranberry,*C ranberry* : *Seltzer* : *W hole* = 3 : 1 : 4

For Fancy Lem onade,*Lem on* : *Seltzer* : *W hole* = 1 : 2 : 3

Since the tw o glasses that are m ixed are the sam e size,you can choose a sm art num ber to represent the volum e of a glass.This num ber should be a m ultiple of both 4 and 3,according to the ratios above,so it is convenient to say that a glass is 12 ounces.M ultiply the Party C ranberry ratio by 3 and the Fancy Lem onade ratio by 4,in both cases to get 12 total ounces.

For Party C ranberry,*C ranberry* : *Seltzer* : *W hole* = 9 : 3 : 12

For Fancy Lem onade,*Lem on* : *Seltzer* : *W hole* = 4 : 8 : 12

Finally,w hen the tw o glasses are m ixed,the resulting total is 24 ounces,of w hich 9 ounces are cranberry juice but 3 + 8 = 11 ounces are seltzer.There is m ore seltzer in the resulting m ix,so its fraction of the m ix is greater than cranberry juice's fraction of the m ix.Q uantity B is greater.

25.**(D).**W rite the ratios as fractions and set them equal to each other.

$$\frac{16}{g}=\frac{g}{49}$$

C ross m ultiply to get 16 × 49 = g^2.

R em em ber that w hen you "unsquare" an equation,you m ust account for the negative possibility.The value of *g* could be *either* 4 × 7 = 28 *or negative* 28.N othing in the problem indicates that *g* m ust be positive.Since Q uantity A m ight equal Q uantity B *or* be less than Q uantity B ,the relationship cannot be determ ined from the inform ation given.

26.**(D) 30.**Since vehicles m ust be counted w ith w hole num bers and 1/3 of the cars are black,the total num ber of cars m ust be divisible by 3.O therw ise,1/3 of the total w ould not be a w hole num ber.The answ er m ust be (B) or (D).

The rem ainder of the cars is 1 – 1/3 = 2/3 of the total.O f these,1/5 are w hite,so 1/5 of 2/3,or $\frac{2}{15}$ of the total num ber of vehicles are w hite.A gain,because the w hite cars m ust be countable w ith w hole num bers,$\frac{2}{15}$ of the total m ust be an integer.Y ou can w rite the equation using fractions:

$$\left(\frac{2}{15}\right)(\text{Total})=\text{Integer}$$

To get an integer outcom e,the total m ust be divisible by 15.O f the answ er choices,only (D) is divisible by 15.

27.**(D).**The ratio of D avid's chocolates to Fouad's chocolates is 1 : 5,w hich you can represent as *x* and 5*x*, respectively,using an unknow n m ultiplier.Together,D avid and Fouad received *x* + 5*x* = 6*x* chocolates.

Since Stina received 80% of the total,D avid and Fouad received 20% of the total,or 1/5 of the total.Thus,the total is 5 tim es w hat D avid and Fouad received,or 5(6*x*) = 30*x*.Stina received 80% of this total,or 24*x*.Y ou could get to Stina’s num ber directly — since she gets 4/5 of the total and the others get 1/5,she gets 4 tim es as m any chocolates as D avid and Fouad together,or 4(6*x*) = 24*x*.

Finally,the ratio of Stina’s chocolates to D avid’s is 24*x* to *x*,or 24 : 1.

28.**(C).**To figure out the “lim iting factor,” take the num ber of players available for each position and figure out how m any team s could be form ed in each case,if there w ere m ore than enough players in all the other positions.

Forw ards: 23 players available ÷ 2 forw ards needed per team = 11.5 team s (if there could be partial team s) = 11 com plete team s,rounding dow n.

G uards: 21 players available ÷ 3 guards needed per team = 7 com plete team s.

G oalies: 9 players available ÷ 1 goalie needed per team = 9 com plete team s.

The guards are the lim iting factor,because the few est com plete team s can be form ed w ith them .O nly 7 com plete team s can be form ed,using all of the available guards and som e of the other players.A total of 7 × 2 = 14 forw ards are required,leaving 23 - 14 = 9 unused forw ards.Likew ise,7 × 1 = 7 goalies are required,leaving 9 - 7 = 2 unused goalies.In all,there are 9 + 2 = 11 unused players,w ho w ill not be on a team .

29.**(E).**Since the ratio of ingredients is 3 : 2 : 1 in the recipe,im agine that Larry w orks in cups.Then a recipe m akes 3 + 2 + 1 = 6 cups of dressing.To figure out the “lim iting factor,” take each available am ount of ingredient and figure out how m any tim es he could m ake the recipe,perm itting fractions,if he had m ore than enough of the other ingredients.

O il: 8 cups available ÷ 3 cups needed per recipe = 8/3 recipes (in other w ords, $2\frac{2}{3}$ tim es the recipe).There is no need to round dow n,because fractional cups of ingredients are allow ed.

V inegar: 7 cups available ÷ 2 cups needed per recipe = 7/2 recipes (in other w ords, $3\frac{1}{2}$ tim es through the recipe).

W ater availability is not lim ited,so ignore it.

O il is the lim iting factor,because Larry can m ake the few est recipes w ith it.Thus,he can only m ake 8/3 recipes.To find the total cups of salad dressing,m ultiply this fraction by the total num ber of cups that a recipe m akes:

$\frac{8}{3}$ recipe × 6 cups per recipe = 16 cups

30.**(D).**C reate a unit conversion factor,using the given ratio of oranges to dollars.The conversion factor w ill look like either $\frac{5 \text{ oranges}}{y \text{ dollars}}$ or $\frac{y \text{ dollars}}{5 \text{ oranges}}$.W hich one you use depends on how you w ant to convert the units.

Y ou are given 25 oranges and asked how m any dollars,in term s of *y*,these oranges w ill cost.Since you are starting w ith oranges and w ant to get to dollars,choose the conversion unit that cancels oranges and leaves dollars on top: $\frac{y \text{ dollars}}{5 \text{ oranges}}$.Then m ultiply:

$$(25 \text{ oranges})\left(\frac{y \text{ dollars}}{5 \text{ oranges}}\right)=\frac{25y}{5} \text{ dollars}=5y \text{ dollars}$$

Intuitively,a total of 25 oranges is the sam e as 5 sets of 5 oranges each.Each set costs *y* dollars.Therefore,the total cost for 5 sets of oranges is 5 × *y* = 5*y*.

31.**(D).**The ratio of black socks to w hite socks is 3 : 4,so you can represent the num ber of black socks as 3*x* and the num ber of w hite socks as 4*x*,w ith *x* as the unknow n m ultiplier.

Y ou are told that there are 15 black socks,so set that equal to the expression for black socks and solve for *x*:

$3x = 15$

$x = 5$

The total num ber of socks is 3*x* + 4*x* = 7*x*,so there are 7(5) = 35 socks total in the draw er.

32.**(D).**Translate the second sentence from a ratio to a rate.The grow th of the tree,divided by the tim e it spends grow ing,is 4/*x*.In other w ords,the constant rate of grow th is 4/*x* feet per year.

N ow apply the form ula D istance = R ate × Tim e.

$$\text{Distance}=\left(\frac{4 \text{ feet}}{x \text{ years}}\right)(10 \text{ years})=\frac{40}{x} \text{ feet}$$

W ithout know ing *x*,it cannot be determ ined w hether Q uantity A is greater or less than Q uantity B .For exam ple,if the tree grow s 4 feet every year (*x* = 1),the tw o quantities are equal.If the tree grow s 4 feet every 10 years (*x* = 10),then Q uantity B is greater than Q uantity A (w hich w ould be 4).

33.**(C).**W ork problem s can be solved in various w ays;this explanation takes an approach involving ratios.Start w ith w hat you know — 10 robots can paint 3 houses in 5 hours.Tw ice as m any robots can paint tw ice as m any houses in the sam e am ount of tim e.In other w ords,the ratio 10 robots : 3 houses = 20 robots : 6 houses.That is,the 20 robots in question can paint 6 houses in 5 hours.

B ut 12 houses need painting,not 6.That’s tw ice as m any houses to paint.Since the rate at w hich the robots w ork is constant,a given set of robots w ill take tw ice as long to paint tw ice as m any houses.So,to paint 12 houses,the 20 robots need 2 × 5 hours = 10 hours.

34.**(C).**R ate problem s can be solved in various w ays;this explanation takes an approach involving ratios.If D ick takes tw ice as long as Jane to run any distance,then he m ust run half as fast.So the ratio of D ick's speed to Jane's speed is 1 : 2.B ecause *Rate* × *Tim e* = *D istance*,this also m eans that for a fixed period of tim e,the ratio of the distances they run is also 1 : 2.That is,D ick only covers half the distance Jane covers in the sam e am ount of tim e.They start running at the sam e m om ent and stop running w hen they m eet,so they do run for the sam e am ount of tim e.

N ow use a Part : Part : W hole relationship.Since together,D ick and Jane run the w hole distance,D ick's distance : Jane's distance : Total distance ratio m ust be 1 : 2 : 3.D ick runs $\frac{1}{}x$,Jane runs $\frac{2}{}x$,and the total distance is $\frac{3}{}x$. Thus,Q uantity A equals Q uantity B .

35.**(D).**First find how m any boxes 1 robot can pack in 1 hour.Since it is given that 1 robot can pack a box in 15 m inutes,m ultiply by the conversion ratio of 60 m inutes to 1 hour:

$$\left(\frac{1 \text{ box}}{15 \text{ minutes}}\right)\left(\frac{60 \text{ minutes}}{1 \text{ hour}}\right)=\frac{4 \text{ boxes}}{1 \text{ hour}}$$

This result should m ake intuitive sense.Each hour contains four 15-m inute segm ents.A robot can build 1 box in each of these 4 segm ents,so 4 boxes per hour are packed by one robot.

The rate is the sam e for all robots,so if 1 robot can build 4 boxes in 1 hour,then 16 robots can build 16 tim es as m any boxes in the sam e am ount of tim e.16 × 4 boxes per hour = 64 boxes in one hour.

36.**(A).**The total am ount of m oney left over after paying rent and buying food is $40.From this num ber,you can find her total w eekly salary by determ ining w hat fraction this is of her total salary.

Since the w om an spent 5/8 of her salary on rent,she had 1 - 5/8 = 3/8 of her salary rem aining.O f the rem ainder,she spent 1/3 on food and had 2/3 left over.So,2/3 of 3/8 of her total w eekly salary w as left over for other expenses.

$$\left(\frac{2}{3}\right)\left(\frac{3}{8}\right)=\frac{2}{8}=\frac{1}{4}$$

O ne quarter of her salary w as the $40 left over.If *T* is her total w eekly salary,then

$$\left(\frac{1}{4}\right)T=\$40$$

$$T=\$160$$

37.**(C).**U se the unknow n m ultiplier,*x*,for the first ratio given.Since the ratio of w ater to acetone is 1 : 2,m ake the am ount of w ater *x* and the am ount of acetone 2*x*.A fter 200 m L of w ater are added to the m ixture,there w ill be *x* + 200 m L of w ater.N ow w rite the new ratio:

$$\frac{\text{Water}}{\text{Acetone}} = \frac{x+200}{2x} = \frac{2}{3}$$

C ross m ultiply and solve for x:

$3x + 600 =$
$4x$ $x = 600$

Finally,com pute the original volum e of the m ixture.The original volum e of w ater is x = 600 m L,w hile the original volum e of acetone is $2x$ = 2(600) = 1,200 m L .Therefore,the total original volum e is 600 + 1200 = 1800 m L .

38.**(E).**R ew rite the given ratio using the unknow n m ultiplier x,so that the length of the rectangle is $3x$,w hile the w idth is $2x$.N ow express the area of the rectangle in these term s,set it equal to 150 square centim eters,then solve for x:

A rea = (Length)(W
idth) 150 = (3x)(2x)
$150 = 6x^2$
$25 = x^2$
$x = 5$ cm

In this case,you don't need to w orry about the negative possibility for the square root,since lengths cannot be less than zero.The length is $3x$ = 15 centim eters,w hile the w idth is $2x$ = 10 centim eters.

Finally,the perim eter of a rectangle is tw ice the length,plus tw ice the w idth:

Perim eter = 2 × length + 2 × w idth
Perim eter = 2 × 10 cm + 2 × 15 cm
Perim eter = 20 cm + 30 cm
Perim eter = 50 cm

39.**(B).**O ne w ay to approach this problem is to pick a sm art num ber for the num ber of students,w hich show s up in both ratios.In the first ratio,students are represented by 8,so you w ant the sm art num ber of students to be a m ultiple of 8.Likew ise,in the second ratio,students are represented by 5,so you w ant the sm art num ber of students to be a m ultiple of 5 as w ell.So pick 40 for the num ber of students.

From here,solve for the num ber of professors.

$$\frac{\text{Students}}{\text{Professors}} = \frac{40}{\text{Professors}} = \frac{8}{1}$$

40 = 8 × Professors
5 = Professors

Likew ise,solve for the num ber of adm inistrators.

$$\frac{\text{Students}}{\text{Administrators}} = \frac{40}{\text{Administrators}} = \frac{5}{2}$$

40 × 2 = 5 × A dm inistrators
16 = A dm inistrators

Therefore,the ratio of professors to adm inistrators is 5 : 16.In fractional ratio form ,this is $\frac{5}{16}$.C om paring the tw o quantities,both have the sam e num erator,but the denom inator of Q uantity A is greater,m aking it the sm aller value.In fact,Q uantity B is exactly tw ice as great as Q uantity A .

40.**(A).**To determ ine the num ber of pounds of leftover pasta,find the am ount of pasta actually served to the guests w ho actually attended,and subtract from the total am ount of pasta originally prepared.O riginally,M ary prepared *x* pounds of pasta for *y* people.C reate a ratio of pasta to people: each person w as supposed to receive $\frac{x}{y}$ pounds of pasta.Since *z* people attended,w ith the sam e $\frac{x}{y}$ portion for each,you can w rite this equation:

Total Pasta Served = (*z* guests)($\frac{x}{y}$ pounds per guest) = $\frac{zx}{y}$ pounds of pasta served

Finally,com pute the excess.Extra Pasta = O riginal A m ount Prepared – A m ount Served $= x - \frac{zx}{y}$

N o answ er choice m atches this expression,so use a com m on denom inator to com bine term s and then reduce:

$$\text{Extra Pasta} = \frac{xy}{y} - \frac{zx}{y} = \frac{xy - zx}{y} = \frac{x(y-z)}{y}$$

41.**(B).**Let *x* be the num ber of ham m ers that Sara purchased from the store.Since there w ere 10 m ore w renches than ham m ers,she received *x* + 10 w renches.The ratio of w renches to ham m ers is 5 : 4,so you can w rite a proportion:

$$\frac{\text{Wrenches}}{\text{Hammers}} = \frac{x+10}{x} = \frac{5}{4}$$

C ross m ultiply and solve for *x*:

$(4)(x + 10) = 5x$
$4x + 40 = 5x$
$x = 40$

Q uantity A is 40,w hich is less than 50.

Q uantity B is greater.

42.**(A).**To m ake the com parison,you m ust determ ine the tim e it takes for the fam ily to drive both to their vacation destination and back hom e.R ecall the form ula for rates problem s:

D istance = R ate × Tim e.This can be rearranged to = $\frac{\text{Distance}}{\text{Rate}}$.

The drive is 100 m iles each w ay,so half the distance is 50 m iles.The first half of the drive to

the vacation destination w as covered at 50 m iles per hour:

$$\frac{\text{Distance}}{\text{Rate}} = \frac{50 \text{ miles}}{50 \text{ miles per hour}} = 1 \text{ hour}$$

The second half of the drive w as covered at 20 m iles per hour:

$$\frac{\text{Distance}}{\text{Rate}} = \frac{50 \text{ miles}}{20 \text{ miles per hour}} = 2.5 \text{ hours}$$

Thus,the total tim e for the drive to the vacation destination is 1 hour + 2.5 hours = 3.5 hours.Q uantity A is 3.5.

The tim e for the drive hom e is $\frac{\text{Distance}}{\text{Rate}} = \frac{100 \text{ miles}}{30 \text{ miles per hour}} = 3.333...$ hours.Q uantity B is $3.\overline{3}$.

Thus,Q uantity A is greater.

43.**(C).**In order to solve this rates problem ,rem em ber the form ula for w ork: W ork = R ate × Tim e.

The total w ork is 8 gallons (a fully filled bucket).The hose is w orking against the leak,so the effective total rate w ill be the difference of the tw o rates:

Effective rate of filling = 3 gallons per m inute in – 1 gallon per m inute out = 2 gallons per m inute

Therefore,by W ork = R ate × Tim e:

$\frac{8 \text{ gallons}}{2 \text{ gallons per minute}}$ = Tim e to fill

Tim e to fill = 4 m inutes

44.**(D).**To solve this problem ,convert D an’s rate from w idgets per second to w idgets per hour.C onceptually,there are tw o steps: first convert seconds to m inutes,then convert m inutes to hours.The fast w ay to do this tw o-step conversion is to m ultiply the rate by the right conversion factors,w hich express identities (such as 60 m inutes = 1 hour) in the form of ratios: $\frac{60 \text{ minutes}}{1 \text{ hour}}$ or $\frac{1 \text{ hour}}{60 \text{ minutes}}$. If you m ake sure that the units cancel correctly,then you can alw ays be sure under pressure w hether to m ultiply or divide by 60.

H ere is the conversion,done all in one line:

$$\left(\frac{10 \text{ widgets}}{15 \text{ seconds}}\right)\left(\frac{60 \text{ seconds}}{1 \text{ minute}}\right)\left(\frac{60 \text{ minutes}}{1 \text{ hour}}\right)=\frac{2,400 \text{ widgets}}{1 \text{ hour}}$$

N otice that seconds and m inutes both cancel on the left.In 1 hour,D an can m ake 2,400 w idgets.

45.**(E).**Y ou w ant to convert an am ount of m oney in "lem uw s" to "rubels." C onceptually,there are tw o steps: first convert lem uw s to schillings,then convert schillings to rubels.The fast w ay to do this tw o-step conversion is to m ultiply the m oney by the right conversion factors,w hich express identities (such as 8 rubels = 1 schilling) in the form of $\frac{8 \text{ rubels}}{1 \text{ schilling}}$ or $\frac{1 \text{ schilling}}{8 \text{ rubels}}$. If you m ake sure that the units cancel correctly,then you can alw ays be sure under pressure w hether to m ultiply or divide by 8.

H ere is the conversion,done all in one line:

$$(6 \text{ lemuws})\left(\frac{5 \text{ schillings}}{1 \text{ lemuw}}\right)\left(\frac{8 \text{ rubels}}{1 \text{ schilling}}\right)=240 \text{ rubels}$$

B oth lem uw s and schillings cancel on the left,leaving rubels.6 lem uw s are w orth 240 rubels.

46.**(C).**To com pute the tim e it takes K im to paint the house alone,use an unknow n m ultiplier.Since the ratio of K im 's tim e to Jane's tim e is 3 : 5,K im 's tim e can be w ritten as $3x$,w hile Jane's tim e is $5x$.The w ork in both cases is 1 house.Since R ate = $\frac{\text{Work}}{\text{Time}}$,you can w rite K im 's rate as $\frac{1}{3x}$ and Jane's rate as $\frac{1}{5x}$.

To find the speed at w hich the tw o people w ork together,add their rates.This com bined rate m ust equal the rate at w hich they paint 1 house.Since it takes them 10 hours w orking together to paint a house,the com bined rate is $\frac{1}{10}$.

K im 's rate + Jane's rate = C om bined rate

$$\frac{1}{3x}+\frac{1}{5x}=\frac{1}{10}$$

Solve for x by finding a com m on denom inator on the left ($15x$) and adding:

$$\frac{5}{15x}+\frac{3}{15x}=\frac{1}{10}$$

$$\frac{8}{15x}=\frac{1}{10}$$

$$80=15x$$

$$16=3x$$

$$\frac{16}{3}=x$$

Finally,K im 's tim e is not *x* but $3x=(3)\left(\frac{16}{3}\right)$.The tw o quantities are equal.

47.**(B).**To solve this ratios problem ,choose sm art num bers for the m oney collected for each team and the num ber of students on each team .C hoose m ultiples of the ratios given,such as the follow ing:

Money collected by Team A = $10
Money collected by Team B = $12
N um ber of students in Team A = 2
N um ber of students in Team B = 3

Then com pute the m oney per student:

Money per student in Team A = $10 / 2 = $5 per student
Money per student in Team B = $12 / 3 = $4 per student

Thus,the ratio of m oney per student in Team A to m oney per student in Team B is 5 : 4.

A lternatively,you could solve this problem algebraically by creating unknow n m ultipliers that m ust eventually cancel, but this m ethod is m ore w ork.

A s a shortcut,you could express each ratio as a fraction,then divide the fractions:

$$\frac{\text{Ratio of money collected}}{\text{Ratio of students}}=\frac{5/6}{2/3}=\frac{5}{6}\times\frac{3}{2}=\frac{5}{4}$$,w hich is 5:4.

48.**(B).**If ketchup,soy sauce,and m ayonnaise are m ixed together in a ratio of 3 : 2 : 5,then there are 2 parts of soy sauce for every 3 + 2 + 5 = 10 parts total.In other w ords,soy sauce com prises $\frac{2}{10}$ of the total m ixture.Thus,if the total m ixture volum e is 25 ounces, $\frac{2}{10} \times 25 = 5$ ounces of that is soy sauce.

49.**(B).**B egin by com puting the tim e spent running from point A to point B .D efine the variable *x* as the tim e Saul spent running from B to A .The trip from A to B took $\frac{3}{4}$ as m uch tim e,so the tim e spent from A to B is $\left(\frac{3}{4}\right)x$ .The total tim e w as 63 m inutes:

$$63 = \left(\frac{3}{4}\right)x + x$$

$$63 = \left(\frac{7}{4}\right)x$$

$$63\left(\frac{4}{7}\right) = x$$

$$9 \times 4 = x$$

$$x = 36 \text{ minutes}$$

The tim e for the trip from A to B w as $\left(\frac{3}{4}\right)x = \left(\frac{3}{4}\right)(36) = 27$ m inutes

N otice that you never need the typical rate equation (D istance = R ate × Tim e),as the Part : Part : ratio given for running tim es and the W hole trip tim e w ere enough to solve for tim e directly.

Q uantity B is greater.

50.**(C).**To find how m uch vinegar Jarod needs,think about how m any m ultiples of his original recipe Jarod w ants to m ake.The original recipe m akes 2 cups of sushi rice,so 7 cups of rice is $\frac{7}{2}$ tim es his original recipe.

Since Jarod is scaling proportionally,to m ake $\frac{7}{2}$ tim es the usual am ount of rice,he m ust also use $\frac{7}{2}$ tim es as m uch vinegar.Therefore,Joe m ust use:

$$\left(\frac{7}{2}\right)\left(\frac{2}{3} \text{ ounces}\right) = \frac{7}{3}$$

A lternatively,you can start w ith 7 cups of rice and m ultiply by the recipe’s ratio of vinegar to rice,cancelling cups of rice and producing ounces of vinegar:

$$(7 \text{ cups of rice})\left(\frac{\frac{2}{3} \text{ ounces of vinegar}}{2 \text{ cups of rice}}\right) = \frac{7}{3} \text{ ounces of vinegar}$$

51.**(A).**Y ou are looking for the average rate for the entire trip.U se D istance = R ate × Tim e,rearranging to get $\frac{\text{Total Distance}}{\text{Total Time}}$.

D efine the distance from Shelbyville to B akersfield as *y*.This w ay,the distance from Springfield to Shelbyville,w hich is tw ice as far,is 2*y*.(N otice that *y* w ill have to vanish by the end of the problem .)

N ow com pute the tim e from Springfield to Shelbyville,given that the rate of travel is *x* m iles per hour.

Tim e from Springfield to Shelbyville = $\frac{\text{Distance}}{\text{Rate}} = \frac{2y}{x}$

Sim ilarly,com pute the tim e from Shelbyville to B akersfield:

Tim e from Shelbyville to B akersfield = $\frac{\text{Distance}}{\text{Rate}} = \frac{y}{1.5x}$

Thus,the total travel tim e is the sum of the tw o tim es: Total Tim e = $\frac{2y}{x} + \frac{y}{1.5x}$

U sing a com m on denom inator (3*x*),add the tw o fractions: Total Tim e = $\frac{6y}{3x} + \frac{2y}{3x} = \frac{8y}{3x}$

C om pute the total distance,w hich equals 2*y* + *y* = 3*y.*

N ow you can figure out the average rate:

A verage R ate = $\frac{\text{Total Distance}}{\text{Total Time}} = \frac{3y}{8y/3x} = \frac{9xy}{8y} = \frac{9}{8}x$

A lternatively,since the variable *x* appears in the answ er choices,you could pick num bers.H ow ever,because of the com plexity of this problem ,it is difficult to pick num bers that both fit the constraints and don’t yield m essy fractions.

52.**(B).**Solve for the cost of a papaya by translating the inform ation given into m athem atical statem ents.The first sentence tells you that 3 bananas,2 apples,and 1 m ango cost $3.50.Letting *B* represent the cost of a banana,*A* the cost of an apple,and *M* the cost of a m ango,w rite

$3B + 2A + M = \$3.50$

Sim ilarly,for the second sentence w rite

$3B + 2A + P = \$4.20$ (w here P is the cost of a papaya)

The problem asks for the cost of a papaya and provides the ratio of the costs of a m ango and papaya.To use this inform ation,you m ust rem ove bananas and apples from the list of unknow ns.H ere's how : try elim ination. Specifically,subtract the first equation from the second:

$$
\begin{array}{l}
3B + 2A + P = \$4.20 \\
\underline{- (3B + 2A + M = \$3.50)} \\
P - M = \$0.70
\end{array}
$$

N ow ,since the ratio of the cost of a m ango to a papaya is 3 : 5,w rite a proportion:

$\frac{M}{P} = \frac{3}{5}$,w hich becom es $M = \frac{3}{5}P$ if you isolate M .N ow substitute back into the equation above,to elim inate M and solve for P:

$$P - M = \$0.70$$

$$P - \frac{3}{5}P = \$0.70$$

$$\frac{5}{5}P - \frac{3}{5}P = \$0.70$$

$$\frac{2}{5}P = \$0.70$$

$$P = \frac{5}{2}(\$0.70) = \$1.75$$

Q uantity B is greater.

53.**(C).**To solve for the num ber of unem ployed fem ales,first com pute the total num ber of people w ho are unem ployed.Y ou need to represent the total num ber of people in the tow n.C all this num ber x.Since 2/5 of the tow n is em ployed,a total of 40,000 people,w rite the ratio

$$\frac{\text{Employed}}{\text{Total population}} = \frac{40{,}000}{x} = \frac{2}{5}$$

C ross m ultiply and solve for x:

$5(40{,}000) = 2x$
$200{,}000 = 2x$
$100{,}000 = x$

40,000 people in the tow n are em ployed,so 100,000 - 40,000 = 60,000 people are unem ployed.

Finally,the ratio of unem ployed m ales to fem ales is 5 : 7.In other w ords,out of every 5 + 7 = 12 unem ployed people, there are 7 unem ployed fem ales.Therefore,the fraction of unem ployed fem ales in the total unem ployed population is 7 out of 12,or 7/12.Setting *y* as the num ber of unem ployed fem ales,w rite

$$\frac{\text{Unemployed females}}{\text{Total unemployed}} = \frac{y}{60{,}000} = \frac{7}{12}$$

Solve for *y:* $y = \frac{7 \times 60{,}000}{12} = 7 \times 5{,}000 = 35{,}000$ unem ployed fem ales.

54.**(C).**R educe the ratio in Q uantity A to low est form .To do so,convert both num bers to im proper fractions first:

$$2\frac{11}{12} = 2 + \frac{11}{12} = \frac{2 \times 12}{12} + \frac{11}{12} = \frac{2 \times 12 + 11}{12} = \frac{24 + 11}{12} = \frac{35}{12}$$

$$1\frac{3}{4} = 1 + \frac{3}{4} = \frac{4}{4} + \frac{3}{4} = \frac{4 + 3}{4} = \frac{7}{4}$$

N ow com pute the ratio by dividing the tw o num bers and sim plifying:

$$\text{Ratio} = \frac{2\frac{11}{12}}{1\frac{3}{4}} = \frac{35/12}{7/4} = \frac{35}{12} \times \frac{4}{7} = \frac{5}{3}$$

The tw o quantities are equal.

55.**(E).**A ccording to the problem ,3/5 of an inch on the m ap is equivalent to 400 m iles of actual distance.So you can set up a ratio of these tw o m easurem ents to use as a conversion factor: $\frac{3/5 \text{ inch}}{400 \text{ miles}}$ or $\frac{400 \text{ miles}}{3/5 \text{ inch}}$.W hich one you use depends on w hich w ay you’re converting: from m iles to inches,or vice versa.

Y ou are told that O klahom a C ity is separated from D etroit by approxim ately 3/2 inches on the m ap,and you are asked how m any real m iles,approxim ately,lie betw een the tw o cities.Since you w ant to go from inches to m iles,m ultiply the given m easurem ent (3/2 inches) by the conversion factor that w ill cancel out inches and give you m iles:

$$\left(\frac{3}{2}\text{ inches}\right)\left(\frac{400\text{ miles}}{3/5\text{ inch}}\right)=\left(\frac{3}{2}\right)(400)\left(\frac{5}{3}\right)\text{ miles}=1,000\text{ miles}$$

56.**(C).**First,figure out how m any boxes w orth of cans the m achine produced in the 2 hours that it w as on.The first step is to find the num ber of cans produced in 2 hours.U se the form ula W ork = R ate × Tim e.20 cans per hour is the rate,and 2 hours is the tim e:

W ork = (20 cans per hour) × (2 hours) = 40 cans

N ow ,since there are 10 cans per box,com pute the num ber of boxes:

N um ber of boxes = 40 cans × $\left(\frac{1\text{ box}}{10\text{ cans}}\right)$ = 4 boxes

So M aria m ust pack 4 w hole boxes to accom m odate all the cans that the m achine had m ade.

O ne m ore tim e,use the form ula W ork = R ate × Tim e.M aria's rate is 3 boxes per hour,w hile the total w ork as 4 boxes.R earrange and plug in:

$$\text{Time}=\frac{\text{Work}}{\text{Rate}}=\frac{4\text{ boxes}}{3\text{ boxes per hour}}=\frac{4}{3}\text{ hours}$$

Finally,convert from hours to m inutes as the question dem ands.

$$\text{Time}=\frac{4}{3}\text{ hours}\times\left(\frac{60\text{ minutes}}{1\text{ hour}}\right)=80\text{ minutes}$$

57.**(B).**First,assign variables to unknow n quantities.Let *y* be Joe's starting salary w ith C om pany X and *z* be the am ount of m oney that Joe's pay is increased each year.Joe has seen 10 raises of *z* dollars each,so Joe has had a total raise since he started of 10*z* dollars.

Joe's pay now is his starting pay plus the ten raises,or *y* + 10*z.*

A lso,the ratio of his pay now to his pay w hen he started is 5 : 2.W rite this relationship as a proportion:

$$\frac{y+10z}{y}=\frac{5}{2}$$

C ross m ultiply and sim plify:

$2(y + 10z) = 5y$
$2y + 20z = 5y$

$3y = 20z$

Finally, the problem asks for the ratio of Joe's yearly increase, z, to his starting pay, y. Rearrange the equation to put $\frac{z}{y}$ by itself:

$$\frac{z}{y} = \frac{3}{20}$$

58. **II and III only.** If Beth has 1/4 more money than Ari, their money is in a ratio of 5 : 4 (because 5 is 1/4 more than 4). Another way to see this result is with algebra:

$$B = A + \frac{1}{4}A = \frac{5}{4}A, \text{ so } \frac{B}{A} = \frac{5}{4}.$$

As a result, for every \$9 total, Beth has \$5 and Ari has \$4. To keep both Ari and Beth in integer dollar values, the answer needs to be a multiple of 9. Among the answer choices, only 54 and 72 are multiples of 9.

59. **I and IV only.** Since salesperson A sold 35% more motorcycles than salesperson B, their sales are in a ratio of 135 : 100. You can reduce this ratio to 27 : 20 by cancelling a common factor of 5.

As a result, for every 47 motorcycles sold, salesperson A sold 27 and salesperson B sold 20. The number of motorcycles sold must be integer multiples of these numbers (because you can't sell partial motorcycles — not legally anyway), so the total needs to be a multiple of 47. Among the answer choices, only 47 and 235 are multiples of 47.

60. **II, IV, and V only.** First, figure out which animal there are fewest of. "Twice as many zebras as lions" means Zebras > Lions, and "four times as many monkeys as zebras" means Monkeys > Zebras. So lions are found at the zoo in smallest numbers. To make the calculation straightforward, pick 1 lion as a smart number to start with. Since there are twice as many zebras, there are 2 zebras. Finally, there are four times as many monkeys as zebras, so there are 4 × 2 = 8 monkeys. Putting all that together:

Lions : Zebras : Monkeys = 1 : 2 : 8

So, for every 11 animals (1 + 2 + 8), there are 1 lion, 2 zebras, and 8 monkeys. To preserve integer numbers of lions, zebras, and monkeys, the total number of animals could only be a multiple of 11. Among the answer choices, only 22, 55, and 121 fit the bill.

61. **(E).** To tackle this question, rewrite all these ridiculously named currencies in terms of just one currency, ideally a real currency. Use whatever real currency you like, but here's an example with dollars.

Say that 1 murb is worth \$1.

A galok is worth 40% more than a murb, or 40% more than \$1. A galok is worth \$1.40.

10 terble coins equal 1 galok, so 10 terble coins are worth a total of \$1.40. Each terble coin is worth \$0.14 or 14

cents.

6 barbar coins equal 1 m urb,so 6 barbar coins equal $1.Each barbar coin is w orth $\$\frac{1}{6}$ or $\frac{100}{6}$ cents.

The ratio of the value of 1 terble coin to the value of 1 barbar coin:

$$\frac{1\text{ terble}}{1\text{ barbar}}=\frac{14\text{ cents}}{100/6\text{ cents}}=14\times\frac{6}{100}=\frac{21}{25}$$

62.**(A).**M anipulate the given ratios to create one ratio that includes all three colors.Y ou m ight use a table:

R	B	O
1	2	
6		1

The problem here is the red car: that colum n contains both a 1 and a 6.In order to fix this issue,create a com m on term .M ultiply the entire first ratio (the first row) by 6:

R	B	O
6	12	
6		1

N ow that the sam e num ber is in both row s of the red colum n,you can com bine the tw o row s into a single ratio:

R : B : O = 6 : 12 : 1

For every 19 cars (6 + 12 + 1),there are 6 red cars,12 blue cars,and 1 orange car.To m aintain w hole num bers of cars in each color,the correct answ er has to be a m ultiple of 19.O nly 38 is a m ultiple of 19.

63.**II and IV only.**Since 70% of the clients w ere originally m ale,the other 30% w ere fem ale.So the ratio of m en to w om en w as 7 : 3.In other w ords,B ob's B istro had 7*x* m ale and 3*x* fem ale clients,for a total of 10*x* clients.N otice that *x* m ust be an integer.Thus,the original num ber of clients M U ST have been a m ultiple of 10.

A fter *z* w om en leave,the total num ber of people is equal to 10*x* - *z*,w hich is given as 74.Since 10*x* is a m ultiple of 10,it ends in 0.W hat has to be true about *z*,so that w hen you subtract it from a num ber ending in 0,you get 74? The restriction is that the units digit has to be 6.For instance,10*x* could be 80,and *z* = 6 to m ake 10*x* - *z* = 74.O r 10*x* could be 90,in w hich case *z* w ould be 16.

A nsw er choices 6 and 16 w ork,as proven above.N o other choices have 6 as their units digit.

64.**(C).**The ratio of *b* to *c* is 2 : 1,w hile the ratio of *g* to *c* is 3 : 1.Since the variable com m on to both ratios (*c*) has the sam e num ber (1) in both ratios,you can just com bine to m ake a three-part ratio:

$b : c : g = 2 : 1 : 3$

Put in an unknow n m ultiplier: $b = 2x$,w hile $c = x$ and $g = 3x$.

Thus, $\frac{b+c}{g} = \frac{2x+x}{3x} = \frac{3x}{3x} = 1$ The tw o quantities are equal.